NWFSC Watershed Program Open House

Museum of History and Industry
2700 24th East, Seattle, Washington 98112
October 21, 2003

ABSTRACTS

8:55 – 9:15 Network connections: Implications for salmon conservation – P. Kiffney, C. Greene, and J. Hall

Abstract - Although headwater streams comprise 75-90% of total river kilometers in most watersheds, the importance of headwater streams for the functioning of large river systems has been largely ignored. These headwater streams are major sources of nutrients, woody debris, and sediment, all of which can affect downstream reaches of the river network. Recent research has shown that the physical and biological diversity at tributary junctions, the points in the network where smaller streams enter larger mainstem habitat, is higher compared to points upstream of these junctions. However, researchers have yet to link these observations with individual, population, and community level processes. In this research, we examined whether tributary junctions created productivity and structural gradients, and if so, whether these gradients affected abundance and growth of invertebrates and fish. Our initial findings suggest that tributary junctions can create gradients in nutrients and fish abundance. For example, sculpin abundance and dissolved and total nutrients in mainstem habitat generally peaked around tributary junctions. This research is important because stream ecologists have primarily focused on habitat heterogeneity at small spatial scales, and not on how habitats may be linked. In addition, this research addresses whether headwater streams are important to downstream condition and, therefore, whether headwater streams and the point where they join larger rivers are important for conservation or restoration.

9:15 – 9:35 Potential influences of floodplain ecosystem dynamics on salmon diversity and abundance – T. Beechie, M. Pollock, M. Liermann, S. Morley, A. Senauer, S. Baker, and J. Addison (Dept. of Earth and Space Sciences, U. Washington)

Abstract - Despite a common belief that dynamic riverine ecosystems support productive multi-species fisheries, the influences of river-floodplain dynamics and floodplain land uses on fisheries are poorly understood. In part, this stems from a lack of integration of geomorphological and biological concepts that link fluvial processes to biological diversity and productivity. We classify river-floodplain dynamics in northwestern USA using geomorphological channel patterns, and describe how these patterns predict aspects of biological diversity and productivity. Each channel pattern has a characteristic migration rate that controls floodplain turnover and drives age diversity of channels and floodplain surfaces (patches). Patch age diversity is low in straight channels with low movement rates and mostly old surfaces, as well as in braided channels with high movement rates and mostly young surfaces. Patch age diversity is highest in channels with intermediate movement rates (island braided channels). Vegetation succession drives temporal patterns of biological diversity in individual terrestrial and aquatic patches (alpha diversity). Species richness is highest at intermediate patch ages, while frequently disturbed and rarely disturbed patches have fewer species and differing species compositions. Continual resetting of patches and shifting alpha diversity with increasing patch age drive the aggregate (gamma) diversity of river-floodplain ecosystems.

9:35 – 9:55 Nutrient enhancement of Idaho streams: A large scale experiment – B. Sanderson, P. Kiffney, K. Macneale, C. Tran, and H. Coe

Abstract - Marine-derived nitrogen, phosphorous and carbon that are delivered to the rivers of the Pacific Northwest by spawning salmonids are critical for fueling stream productivity. Because many of the Columbia

Basin streams in which salmon spawn and rear are inherently nutrient poor, the delivery of these marine-derived nutrients may be crucial to survival of juvenile salmon and recovery of depleted salmon populations. While enhancement strategies aimed at increasing the ability of streams to support juvenile salmonids exist, few studies have evaluated their methodology and effectiveness. This project experimentally evaluates the effects of marine derived nutrients on stream productivity and on populations of Snake River spring/summer chinook and steelhead salmon. We have begun a series of mesocosm and field experiments to evaluate the response of these fish, potential predators/competitors (e.g., non-native brook trout) and their food resources to alternative methods of fertilization: (1) carcass additions, (2) carcass analog additions (from Bio-Oregon) and (3) inorganic nutrient addition. Preliminary background data will be presented.

9:55 – 10:15 Restoring incised channels and increasing streamflow in semi-arid watersheds – M. Pollock, T. Beechie, and S. Baker

Abstract - Many streams in the semi-arid regions of the Columbia River basin of eastern Washington and Oregon have experienced moderate to severe incision within the past 150 years, often following dramatic land use changes as the area was colonized by European-Americans. We review the feasibility of using beaver dams and other instream obstructions to raise the bed elevation of incised streams such that they are reconnected to their former floodplains. We also review how filling such incised streams can increase stream flow. Initial calculations suggest that even severely incised streams may be able to be restored in a relatively short (decadal) time frame, provided that abundant riparian vegetation is allowed to re-establish such that it obstructs flow. Aggradation rates may be further increased by allowing beaver to colonize streams so they can build dams, and by providing additional instream obstructions such as rock weirs or large wood. Such structures further decrease flow velocities, providing more opportunities for aggradation. Further, available evidence suggests that such aggradation has the potential to increase groundwater recharge into floodplain aquifers. Discharge of this groundwater in the dry summer months may lengthen the duration of stream flow and potentially perennialize ephemeral streams.

10:30 – 10:50 Recovery planning for ocean-type chinook salmon in the Skagit River: Results from a decade of field studies – E. Beamer (Skagit System Cooperative), C. Greene, A. McBride (Skagit System Cooperative), C. Rice, T. Beechie, and K. Larsen (US Geological Survey)

Abstract - In 1994 the Skagit River tribes initiated field studies to understand wild Skagit Chinook fish-habitat relationships for population recovery purposes. The studies were developed in the context of a life-cycle model framework that includes discrete life stages and habitats for multiple juvenile life history types of ocean-type Chinook salmon. Field studies include: (1) identification of juvenile life history types, (2) inventories of current and historic habitat conditions, and (3) fish use patterns for freshwater, estuarine delta, and Skagit Bay near shore life stages. Cooperating researchers, including WDFW, USGS, and NWFSC have assisted in monitoring, sample processing, and data analysis. Results after a decade of study show: (1) a strong negative relationship of peak flow during incubation with egg-fry survival, (2) a large historical loss of delta estuarine habitat and a high percentage of wild juvenile Chinook positioned to utilize this habitat for extended rearing, (3) evidence for density dependence in the delta and possibly freshwater habitat areas, (4) density-dependent movement by individual migrants, and (5) strong seasonal preferences in nearshore habitat utilization. The results of the field studies lead independently to a solid biological rationale for specific recovery actions that would benefit specific juvenile life history types. We illustrate how using a conceptual life cycle model framework has helped field studies to answer questions regarding the true biological mechanisms influencing Skagit Chinook, which lead to more appropriate prediction of the benefits of recovery actions and to focus future studies. In the future, field study results will be placed within a Skagit specific life-cycle model that can analyze the relationship of specific recovery actions with the overall population dynamics of wild ocean type Skagit Chinook.

10:50 – 11:10 Effects of stream, estuary, and ocean conditions on chinook salmon return rates in the Skagit River – C. Greene, G. Pess, E. Beamer (Skagit System Cooperative), A. Steel, and D. Jensen

Abstract - Fisheries managers tasked with predicting returns of migrating fish are often challenged by significant interannual variability. Returns are influenced by environmental conditions and by density-dependent interactions during multiple life stages. We describe a statistical model relating adult return rates (spawner to spawner productivity estimates) of wild Skagit River chinook salmon to environmental conditions experienced during residency in freshwater, tidal delta, bay, and ocean habitats. This model also includes density dependence (based on total egg production) across life stages. The best model predicting return rates between 1974 and 1990 included eggs; flood recurrence interval (FRI) experienced during incubation; a combination of sea surface temperature (SST), sea level pressure (SLP), sea level, and upwelling experienced during bay residency; and a combination of SST, SLP, and upwelling experienced during the first and third ocean years. This model explained 90% of the variation in return rate. Both FRI and conditions experienced during bay residency each explained approximately 30% of the variation in return rate, while eggs and conditions experienced during first and third ocean years explained the remaining 30% of the variation. These results suggest that 1) returns of wild salmon can be predicted with high precision as long as residency in particular habitats is well known, 2) environmental conditions experienced during freshwater and bay residency time are particularly strong predictors of return rate in Skagit River wild ocean type chinook salmon, and 3) conditions experienced during ocean residency vary among ocean years and are generally less important than conditions experienced during bay residency.

11:10 – 11:30 Spatial and temporal distribution of marked and unmarked juvenile Chinook salmon in nearshore surface waters of Puget Sound: Preliminary results - C. Rice, C. Greene, E. Beamer (Skagit System Cooperative), K. Fresh (FE Division, NWFSC), D. Lomax (EC Division, NWFSC), R. Henderson (Skagit System Cooperative), R. Reisenbichler (US Geological Survey)

Abstract - In 2001 and 2002, we conducted surface trawl (townet) studies to identify and characterize juvenile Chinook salmon (*Oncorhychus tshawytscha*) life history types present in Skagit Bay, Puget Sound, Washington, and to compare spatial and temporal distributions of hatchery and wild juvenile Chinook in nearshore environments. In 2003, sampling was expanded to include five additional river mouth estuaries and several marine areas in between them. This expanded sampling will improve our landscape-scale understanding of the estuarine ecology of juvenile Chinook, including evaluation of effects of different oceanographic characteristics and degrees of human influence. To date, 52 sites have been sampled between the Nooksack River estuary in the north, and the Nisqually River estuary in the south. Over 1000, 10-minute tows have been successfully completed, and over 6,500 juvenile Chinook captured. We found that unmarked Chinook were more widely distributed than marked (adipose fin clipped or coded wire tagged) Chinook with respect to time, space, and individual size. This suggests that wild Chinook use estuarine habitats more extensively than do hatchery fish. In addition, areas in the southern, more urbanized, or hatchery-dominated systems showed higher peak Chinook catches but more rapid seasonal declines in Chinook abundance. Incomplete and inconsistent marking of hatchery fish complicates interpretation of these results. Future work will include detailed analysis of Chinook otoliths, scales, and diet samples, and associated fish assemblage composition.

11:30 – 11:50 Prevalences of bacterial kidney disease (BKD) in juvenile chinook salmon from nearshore Puget Sound – F. Sommers, C. Durkin (REUT Division, NWFSC), C. Rice, and L. Rhodes (REUT Division, NWFSC)

Abstract - Bacterial kidney disease (BKD) is a serious systemic infection in salmonid fishes that can affect survival to salt water acclimation, ocean survival, and spawning returns to fresh water. While there are many reports of BKD prevalences among propagated salmonids, the occurrence of this disease among free-living and wild populations is less well studied. This project aimed to assess the relative prevalences of BKD among out-migrating Chinook salmon (Oncorhynchus tshawytscha) from Puget Sound. Kidney samples from juvenile Chinook salmon were collected from the Skagit River estuary in 2002 and 2003, and from multiple sites in North, Central and South Puget Sound in 2003. These samples are being examined for the presence and severity of Renibacterium salmoninarum (RS), the causative agent of bacterial kidney disease. Samples were collected via nearshore surface

trawls (townet) on a monthly basis from spring to fall. This sampling design will provide a spatially and temporally informed picture of the occurrence and severity of RS infections in Chinook salmon during the transitioning from freshwater to the marine environment, an especially stressful and critical life stage. Comparisons of presence and severity of RS will also be possible between hatchery and wild fish and between urban and non-urban systems across Puget Sound.

11:50 – 12:10 Stable isotope ratios in juvenile salmonids from western Washington streams: Effects of season and adult run size - W. Reichert, R. Bilby (Weyerhaeuser Co.), G. Pess and C. Kraemer (Washington Dept. of Fish and Wildlife)

Abstract – Anadromous salmonids play a significant role in the nutrient dynamics of their natal streams. The marine derived nutrients from salmon carcasses are utilized by the vegetation, invertebrates and vertebrates associated with this stream community. In the present study, the effect of adult return levels on juvenile coho (*Oncorhynchus kisutch*) nutrition was evaluated using stable isotope technology. Coho fry collected in March from seven different sites were found to have stable isotope ratios very similar to values for unfertilized coho eggs. Juveniles (4-7 mo.) collected in June and September from certain sites had substantially lower values than fry for $\delta^{15}N$ indicating appreciable accumulation of nitrogen from nonanadromous sources. Data for coho parr (~1 yr) collected from several streams in March indicated $\delta^{15}N$ ratios increased with coho run size ($p<0.01$). Coho parr $\delta^{15}N$ numbers in streams with higher densities of spawners were approaching $\delta^{15}N$ values for coho carcasses. These results support the contention that as the carcass density increases it will become an increasingly important food resource for coho juveniles, both as a primary source through direct consumption of the carcass and as a secondary source through the prey organisms that feed on the carcasses. These findings support the need to manage salmon escapement to assure that a stream is not starved for the essential nutritional components that carcasses contribute to the productivity of salmonid habitats.

1:20 – 1:40 Predicting ecosystem response to the removal of the Elwha River dams – G. Pess, M. McHenry (Lower Elwha S'Klallam Tribe), T. Beechie, P. Kiffney, H. Coe, M. Heim, K. Kloehn, M. Liermann, T. Bennett, and R. Peters (US Fish and Wildlife Service)

Abstract - Since installation of the first Elwha dam in 1912, decreased sediment and wood supplies to the lower Elwha River have resulted in river entrenchment, decreased abundance of certain riverine habitats, and altered distributions of juvenile and adult salmon. Impending removal of these dams presents an opportunity to explore linkages among changes in sediment supply, in-channel wood abundance, and habitat and ecosystem attributes. Sampling of ecosystem attributes before and after dam removal, as well as in nearby reference rivers will elucidate functional relationships among sediment and wood supply, formation and persistence of river and floodplain habitats, and resultant ecosystem dynamics. Preliminary data indicate that the Elwha dams have not significantly reduced channel movements or floodplain turnover within the current floodplain. However, they have reduced connectivity between the main river and floodplain channels, resulting in two distinct floodplain habitat types (ground-water connected and surface-water connected). Reduced sediment and wood supplies have dramatically reduced availability of spawning and rearing habitats for salmonids, resulting in a concentration of spawning and rearing in areas where gravel and wood are actively recruited from the historical floodplain. Recent restoration efforts through the placement of large logjams below the dams have increased local salmon abundance and species richness by 2 and 5 times in the main channel and secondary habitats. Primary and secondary productivity, which has also been affected by the dams, has also responded to the placement of logjams. These studies provide a basis for predicting ecosystem responses to changes in river dynamics after dam removal.

1:40 – 2:00 Evaluating habitat restoration opportunities for Pacific salmon within the Duwamish River – S. Morley, J. Toft (College of Ocean and Fisheries Science, U. Washington), K. Hanson, A. Pratt, and T. Bennett

Abstract - The Duwamish River estuary is an important transition corridor, nursery habitat, and staging and feeding area for salmon migrating between Elliott Bay and the Green River. Due to extensive hydro-modification and

industrial development along the banks of the Duwamish, there is concern that lack of high-quality estuarine habitat may be a bottleneck on fish production throughout the Green River basin. Millions of dollars have been spent on restoration efforts within the Duwamish, yet little is known about current habitat availability, the role of estuarine shoreline vegetation, or fish habitat utilization within this urban estuary. The objective of this study is to help inform ongoing restoration efforts by (1) inventorying current habitat condition along the nearshore, (2) evaluating differences in habitat quality between reaches with and without shoreline vegetation, and (3) documenting the abundance and distribution of non-indigenous species. During the summer of 2004, we mapped shoreline habitat-type along the 18 km Duwamish River, installed temperature loggers, and collected invertebrate samples at paired study sites with and without vegetation. Along the entire length of the river, the shoreline was extensively armored, with very little shoreline vegetation in the lower river particularly. Maximum temperatures during the summer were significantly higher at unvegetated sites. Preliminary invertebrate results also show differences between paired sites: invertebrate abundance was higher at sites with shoreline vegetation. These results suggest that although restoration efforts may of necessity be very localized in scope, they can still have ecological benefit. This study will help in identifying areas for future restoration, provide important baseline information for restoration monitoring, and help to address the question of the role of shoreline vegetation in estuarine environments.

2:00 – 2:20 Fish and macroinvertebrate responses to boulder weir placement in southwest Oregon streams – T. Bennett, P. Olmstead (Bureau of Land Management), S. Morley, G. Pess, P. Roni, and D. Van Slyke (Bureau of Land Management)

Abstract - The placement of boulders and logs into the active stream channel to improve habitat for salmonid fishes has a long history. However, little work has been done to evaluate the effectiveness of many of these activities, particularly boulder weirs—a common technique in highly simplified bedrock channels along the Oregon coast. In cooperation with the Bureau of Land Management and the Oregon Department of Fish and Wildlife, we examined the effects of boulder weir placement on local habitat and fish abundance. Between 2002 and 2003 we sampled habitat (channel units, wood, boulders), fish (snorkel counts), and macroinvertebrates (surber samples) in 13 paired treatment and control reaches in 7 streams during the summer months. Preliminary results indicate that pool area ($p = 0.02$) was higher in treatment reaches, while large woody debris, boulders, and other habitat metrics were similar between treatment and control reaches. Snorkel surveys indicated that coho abundance was higher in treatment reaches ($p < 0.05$), but trout, dace, and sculpin was not. No difference existed in key macroinvertebrate metrics between treatments and controls. Additional analyses are underway to further examine relationships between fish response and boulder weir placement, and to examine conditions in undisturbed streams. Our initial analysis suggests that boulder weirs may be a useful first step in a series needed to restore highly degraded bedrock stream channels.

2:20– 2:40 Monitoring and evaluating restoration at multiple scales – P. Roni, M. Liermann, and A. Steel

Abstract - We discuss the major scales and questions that need to be addressed to adequately evaluate the effectiveness of various salmon habitat restoration actions, conducted power analysis to determine the strengths and weaknesses of various designs available to answer these questions, and make recommendations on the type of monitoring to use at various scales. The four key questions for monitoring salmon restoration actions are: 1) what is the effect of a single project on local physical habitat or fish abundance, 2) what is the effect of a type of project (multiple projects) on local habitat or fish abundance, 3) what is the effect of an individual project on watershed or a population, 4) what is the effect of a suite of different projects on a watershed conditions or a population. The most appropriate monitoring design will depend in part upon the scale of the question one is asking. Using data from existing studies we estimated the spatial or temporal replication needed to detect responses for common physical and biological responses for a before-after (BA), before-after control-impact (BACI), and extensive post-treatment (EPT) study designs. The length of time needed to detect a 50% significant change in juvenile coho salmon abundance using a BACI or BA design was approximately 30 years, while spatial replication for an EPT design would require approximately 30 sites. If a BACI design was replicated in both space in time (the ideal scenario), our analysis suggest that the trade off between spatial and temporal replication was nearly equal. Thus logistical, financial, and other constraints are more likely to dictate whether sampling more sites or more years is most efficient. Based on our analysis and experience, watershed scale questions (questions 3 and 4) will require a

BACI or BA design with both spatial and temporal replication, while reach scale questions (questions 1 and 2) can be answered using either a BA, BACI, or an EPT design.

2:55 – 3:15 Landscape analyses for recovery science – A. Steel, P. McElhany (CB Division, NWFSC), P. Olson (Pacific Watershed Institute), M. Sheer (CB Division, NWFSC), J. Burke (CB Division, NWFSC), A. Fullerton, D. Jensen, B. Feist, G. Pess, and B. Sanderson

Abstract – Recovery science is the development and assessment of scientific tools that provide insights into the relationships between salmon and their habitats and which are also immediately useful in developing recovery plans for listed species. Current challenges include the design and evaluation of methods for (1) assessing current and historic habitat value for fish, (2) predicting in-stream response to restoration and preservation actions, and (3) estimating fish population responses to changes in in-stream habitat. Estimates must be made over vast areas for which collecting field data and developing detailed models is impossible. Teams at the NWFSC are working on a series of case studies that illuminate both technical difficulties and possibilities in developing the necessary analyses to meet these challenges. We present details on the Lewis River case study in SW Washington. The Lewis River case study combines coarse assessments of watershed processes, more detailed process-based models of those same processes, a detailed literature review, and 4 methods of linking habitat to fish response. We emphasize comparisons between methods with respect to both accuracy and precision. In this presentation, we compare approaches between the Lewis River analyses and other case studies currently underway and we detail linkages between the case studies and other on-going landscape-scale analyses.

3:15 – 3:35 Impacts of barriers on the availability of freshwater habitat in the Willamette and Lower Columbia basins – M.B. Sheer (CB Division, NWFSC) and E.A. Steel

Abstract - Modification of river systems in the form of anthropogenic structural barriers to fish migration and passage has greatly influenced fish distribution. Location and timing of successive barrier placements define zones within watersheds that are unavailable to anadromous and migratory species, such as salmonids. Currently, various types of these barriers block large quantities of both mainstem and tributary habitat in the Pacific Northwest, creating upstream zones of freshwater habitat that are unavailable to fish. We completed an evaluation of characteristics, distribution, and size of these upstream zones and migration barriers in the Willamette and Lower Columbia basins to assess relative differences in blocked areas vs. non-blocked areas. We assessed anthropogenic and physical characteristics of aquatic habitat in these watersheds by incorporating data on man-made and natural barriers into a hydrologic stream network including reach-level physical habitat. One-third of the studied watersheds had > 40% of the stream habitat inaccessible to fish, and all watersheds had >10% of total stream habitat in these upstream zones. The percentage of blocked habitat increases as a function of watershed area. We also present comparisons of potential habitat loss for multiple fish species and life history types, and examine correlations between land-use, barrier placement and relative impact on aquatic habitat.

3:35 – 3:55 A landscape scale analysis of chinook salmon spawning habitat in Puget Sound – B. Sanderson, J. Davies (CB Division, NWFSC), K. Lagueux (CB Division, NWFSC), M. Ruckelshaus (CB Division, NWFSC), and T. Beechie

Abstract - The ability of freshwater habitat to support and sustain healthy populations of salmon has changed markedly from historical conditions. In Puget Sound, where chinook are threatened, we have developed methods for quantifying habitats used by adult and juvenile life stages for both current and historical conditions. Our approach for deriving coarse-scale estimates of existing chinook spawning habitat utilizes existing geospatial data coupled with empirical data from previous studies to develop a spawning suitability index for individual stream reaches. This index is derived using stream gradient, estimated bank full width, and riparian condition. The validity of this approach is being assessed using information from ongoing fine-scale analyses and local watershed groups. Preliminary results indicate that anthropogenic barriers exclude adult chinook from large areas of formerly accessible spawning habitat, and that changes in riparian conditions have reduced the spawning potential of many reaches. Ultimately our results will be used to compare the current and historical potential of Puget Sound

watersheds to support chinook salmon, and to assist local watershed groups in setting protection and restoration goals.

3:55 – 4:15 Environmental correlates of salmon life history diversity: Implications for salmon recovery and climate change – A. Fullerton, T. Beechie, M. Ruckelshaus, E. Buhle (Dept. Biology, U. Washington), and L. Holsinger (US Forest Service)

Abstract - Pacific salmonids exhibit a variety of life history diversities throughout their range. Such diversity may increase the likelihood that a species persists in the face of threats such as land-use, harvest or hatchery practices, and climate change. Conserving life history diversity is important to recovery of listed salmon because risk can be spread among populations with varying responses to environmental perturbations. We investigated relationships among several environmental attributes and life history characteristics of Chinook salmon in Puget Sound. We focused on hydrograph patterns that might affect timing of life history events (e.g., typical peak and low flow patterns, as controlled by regional climate and topography) and stream temperatures likely experienced by incubating salmon eggs and alevins. We examined spawn timing, spawner age and size, and outmigrant age to see if any of these might be correlated with hydroregion or incubation temperature. Median spawn timing was earlier in areas where the annual hydrograph pattern was dominated by snowmelt and later in areas where the hydrograph was dominated by rainfall. Temperature was weakly correlated with spawn timing within the rainfall and transitional hydrologic regimes, but we lacked temperature data for much of the snowmelt regimes so the correlation does not include any of the early spawning populations of Chinook salmon. Other life history traits were less closely associated with either temperature or hydrograph. Our analyses suggest that changes in environmental attributes due to global climate change may threaten early spawning runs of Chinook salmon that occupy snowmelt dominated streams. Losing this life history strategy may compromise the ability of Chinook and other salmonids to recover and persist.

4:15 – 4:35 The influence of non-indigenous smooth cordgrass (*Spartina alterniflora*) on the production base of Pacific Northwest estuaries: Implications for recovery efforts – B. Feist, C. Harvey (FRAM Division, NWFSC), J. Ruesink (Dept. Biology, U. Washington), Alan Trimble (Dept. Biology, U. Washington), Richard Hicks (Cumulative Risk Initiative, NWFSC), and Bill Reichert

Abstract - Non-indigenous smooth cordgrass (Spartina alterniflora) is one of the most conspicuous and widespread non-native aquatic species in Pacific Northwest estuaries. Smooth cordgrass introductions, both accidental and intentional, have occurred in many Washington, Oregon, California, and British Columbia estuaries. Perhaps due to its prolific spread, and the threatening nature of invasive species in general, the presence of smooth cordgrass has been thoroughly characterized as an ecological plague. Ironically, there has been a paucity of research on the role of smooth cordgrass production in the detritus based estuarine food webs where it has invaded. In order to better understand this role, we examined the growth rates and production base of non-indigenous Pacific oysters (Crassostrea gigas) in two Washington coast estuaries (Willapa Bay and Grays Harbor). We measured naturally occurring stable isotope ratios of C, N, and S in adult and post-settled larval oysters, and several organic matter sources, including smooth cordgrass, eelgrasses, benthic algae, seston, and terrestrial leaf litter. We compared patterns in growth and production base as a function of broad scale system attributes and found that there were spatio-temporal trends in both growth rates and the diet of Pacific oysters. These findings have implications for salmon recovery planning since little is known about the influence of exotic species on the production base and subsequently the feeding habits of listed anadromous salmonids in estuaries.